

In the United States Patent and Trademark Office

Serial No. \_\_\_\_\_

Appn. Filed : \_\_\_\_\_



Applicant: Boris Kesil, Elik Gershenzon, and David Margulis

Appn. Title: PRECISION SOFT-TOUCH GRIPPING MECHANISM FOR FLAT  
OBJECTS

Examiner/GAU: \_\_\_\_\_

Mailed: Aug. 31/01  
At: Santa Clara

Information Disclosure Statement

Assistant Commissioner for Patents

Washington, District of Columbia 20231

Sir:

Attached is a completed Form PTO-1449 and copies of the pertinent parts of the references cited thereon. Following are comments on references pursuant to Rule 98:

US Patent No. 5,570,920 issued on November 5, 1996 to J. Crisman et al. describes a robot arm with a multi-fingered hand effector where the fingers are driven from a DC motor via a system of pulleys with control of a grasping force by means of strain gauges attached to the inner surfaces of the fingers. However, such a robot arm is three-dimensional and is not applicable for handling thin flat objects, such as semiconductor wafers, located in deep narrow pockets of a multistack cassette of the type used for storing the wafers.

US Patent No. 6,167,322 issued on December 26, 2000 to O. Hollbrooks describes an Intelligent wafer handling system which removes wafers from the

cassette using a gripper that can slip in between parallel stacked and spaced wafers. A translator solenoid acting through an arm applies lateral movement to the finger to grasp the wafer between the finger and the posts. Grasping action is accomplished by using the finger to press the wafer against the fixed rods. The level of the pressure is maintained through the control of the electrical current applied to the driving translator. A disadvantage of the wafer handling system of Hollbrooks consists in that this apparatus does not provide control of gripping speed at different stages of the gripping cycle. Another disadvantage of the Hollbrooks system consists in that this system does not provide decrease in gripping pressure when the gripper approaches the edge of the wafer with acceleration.

US Patent No. No. 5,504,345 issued on April 2, 1996 to H. Bartunek et al. discloses a dual beam sensor and edge detection system. Two light sources of solid state lasers are used to detect the edges of the wafers in a cassette. The device of Bartunek et al. suffers the same disadvantages as the device of Hollbrooks.

US Patent No. 6,256,555 issued to Paul Bacchi, Paul S. Filipski on July 3, 2001 shows gripping end effectors for a wafer of more than 6 inches in diameter that include proximal and distal rest pads having pad and backstop portions that support and grip the wafer within the annular exclusion zone. The end effector includes a fiber optic light transmitting sensor for the wafer periphery and bottom surface. A disadvantage of the device of US Patent No. 6,256,555 consists in that this device does not allow to divide the gripping process into several stages with different controllable speeds. In order to prevent jerks at the moment of contact of the gripper with the wafer edge, the last stage of movement of the gripping fingers should be carried out with a reduced speed. The decrease in speed, however, reduces productivity of the gripper's operation. This problem is solved neither by the device of US Patent No. 6,256,555 nor by any of previously described devices.

US Patent No. 5,108,140 issued on April 1992 to S. Bartholet discloses a palm plate and grippers having tactile or other sensors on their upper surface to detect the position of the wafer and provide feedback to the control mechanism. A parallel vice-like grip is generated, but there are no means of detecting the real orientation of the wafer relatively to the gripper. To control gripping force directly at the gripping points of the wafer, it is necessary to measure two dimensional coordinates of the plane of the wafer, the relative coordinates, the front and backside edges, and adjust the gripping points to perform real-time measurements and gripping procedures. Other problems are associated with a limited load that robot arm is able to carry and with the amount of wires that can deliver the control and sensing signals to a robot controller.

Thus none of the references mentioned above discloses, as claimed in our independent Claim 1 with dependent Claims 2-20 and in independent Claim 21 with dependent Claims 22-50, a precision soft-touch gripping mechanism that provides control of gripping speed at different stages of the gripping cycle with a decrease in gripping pressure when the gripper contacts the edge of the wafer. Furthermore, none of the above references discloses, as claimed in our Claim 51, a method for gripping precision flat objects including the step of dividing the path of movement of the gripper by several stages with different speeds.

Respectfully,

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FORM PTO-1449 (Substitute)

ATTY. DOCKET NO.

SERIAL NO.

## LIST OF PRIOR ART CITED BY APPLICANT

(Use several sheets if necessary)

APPLICANT

BORIS Kesil, et al.

FILING DATE

GROUP

1046 U.S. PTO  
09/944605

## U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
AA		5,570,920	1996	J. Crisman et al.			
AB		6,167,322	2000	D. Hollbrooks			
AC		5,504,345	1996	H. Bartunek et al.			
AD		6,256,555	2001	P. Bacchi, et al.			
AE		5,108,140	1992	S. Bartholet			
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## FOREIGN PATENT DOCUMENTS

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## OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

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EXAMINER

DATE CONSIDERED

\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.